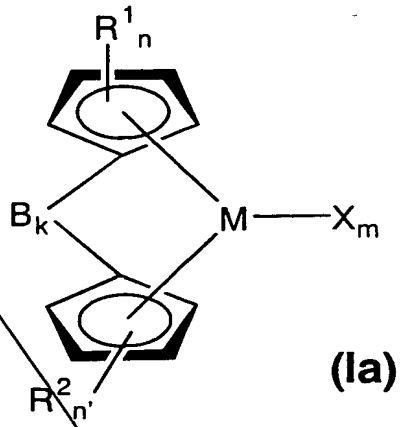
We claim:

1. A process for purifying compounds of the formula (Ia)



(Ia)

where

M is a metal of transition group III, IV, V or VI of the Periodic Table of the Elements, in particular Ti, Zr or Hf, particularly preferably zirconium,

R^1 are identical or different and are each a radical SiR_3^{12}, where R^{12} are identical or different and are each a hydrogen atom or a C_1-C_{40} group, preferably C_1-C_{20}-alkyl, C_1-C_{10}-fluoroalkyl, C_1-C_{10}-alkoxy, C_6-C_{20}-aryl, C_6-C_{10}-fluoroaryl, C_6-C_{10}-aryloxy, C_2-C_{10}-alkenyl, C_7-C_{40}-arylalkyl, C_7-C_{40}-alkylaryl or C_8-C_{40}-arylalkenyl, or R^1 is a C_1-C_{30} group, preferably C_1-C_{25}-alkyl such as methyl, ethyl, tert-butyl, cyclohexyl or octyl, C_2-C_{25}-alkenyl, C_3-C_{15}-alkylalkenyl, C_6-C_{24}-aryl, C_5-C_{24}-heteroaryl, C_7-C_{30}-arylalkyl, C_7-C_{30}-alkylaryl, fluorinated C_1-C_{25}-alkyl, fluorinated C_6-C_{24}-aryl, fluorinated C_7-C_{30}-arylalkyl, fluorinated C_7-C_{30}-alkylaryl or C_1-C_{12}-alkoxy,
or two or more radicals R^1 may be joined to one another in such a way that the radicals R^1 and the atoms of the cyclopentadienyl ring which connect them form a C_4-C_{24}-ring system which may in turn be substituted,

R^2 are identical or different and are each a radical SiR_3^{12}, where R^{12} are identical or different and are each a hydrogen atom or a C_1-C_{40} group, preferably C_1-C_{20}-alkyl, C_1-C_{10}-fluoroalkyl, C_1-C_{10}-alkoxy, C_6-C_{14}-aryl, C_6-C_{10}-fluoroaryl, C_6-C_{10}-aryloxy, C_2-C_{10}-alkenyl, C_7-C_{40}-arylalkyl, C_7-C_{40}-alkylaryl or C_8-C_{40}-arylalkenyl,

or R^2 is a C_1-C_{30} group, preferably C_1-C_{25}-alkyl such as methyl, ethyl, tert-butyl, cyclohexyl or octyl, C_2-C_{25}-alkenyl, C_3-C_{15}-alkylalkenyl, C_6-C_{24}-aryl, C_5-C_{24}-heteroaryl, C_7-C_{30}-arylalkyl, C_7-C_{30}-alkylaryl, fluorinated C_1-C_{25}-alkyl, fluorinated C_6-C_{24}-aryl, fluorinated C_7-C_{30}-arylalkyl, fluorinated C_7-C_{30}-alkylaryl or C_1-C_{12}-alkoxy,
or two or more radicals R^2 may be joined to one another in such a way that the radicals R^2 and the atoms of the cyclopentadienyl ring which connect them form a C_4-C_{24} ring system which may in turn be substituted,

X is a halogen atom, in particular chlorine,
n is from 1 to 5 when k = 0, and n is from 0 to 4 when k = 1,
n' is from 1 to 5 when k = 0, and n' is from 0 to 4 when k = 1,
m is from 1 to 4, preferably 2,
k is zero or 1, where the metallocene is unbridged when k = 0 and is bridged when k = 1, with preference being given to k = 1, and
B is a bridging structural element between the two cyclopentadienyl rings,

comprising the steps:

a) reacting the compound of the formula (Ia) with a ligand exchange component

$$M^1YR^3$$

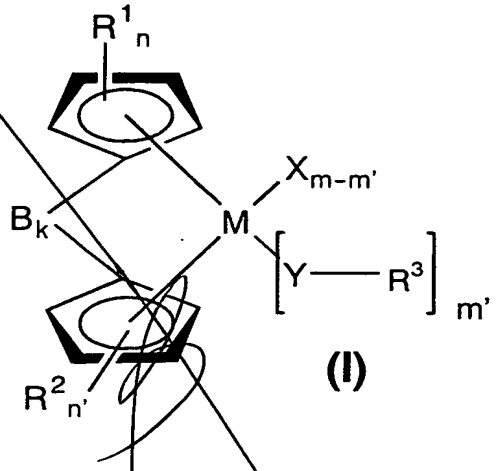
where

M^1 is a cation or a cationic fragment, in particular Li, Na, K, MgCl, MgBr, MgI, or is an ammonium cation corresponding to an amine,

R^3 is hydrogen or a C_1-C_{40} group, preferably C_1-C_{25}-alkyl such as methyl, ethyl, tert-butyl, cyclohexyl or octyl, C_2-C_{25}-alkenyl, C_3-C_{15}-alkylalkenyl, C_6-C_{24}-aryl, C_5-C_{24}-heteroaryl such as pyridyl, furyl or quinolyl, C_7-C_{30}-arylalkyl, C_7-C_{30}-alkylaryl, fluorinated C_1-C_{25}-alkyl, fluorinated C_6-C_{24}-aryl, fluorinated C_7-C_{30}-arylalkyl or fluorinated C_7-C_{30}-alkylaryl,

Y is an element of main group 6 of the Periodic Table of the Elements, in particular oxygen or sulfur, or a fragment CR^3_2, NR^3, $NR^3(CO)$-, $NR^3(SO_2)$-, PR^3 or $P(=O)R^3$, $O(CO)$-, $O(SO_2)$-,

to form the compound of the formula (I)



(I)

where
M, R^1, R^2, R^3, X, Y, n, n', m, k, B and R^{12} are as defined above and
m' is from 1 to 4, preferably 1 or 2,
with the compound of the formula M^1X, where M^1 and X are as defined above, being eliminated, in an inert solvent or solvent mixture,

b) if desired, separating off solid residues of the formula M^1X
c) if desired, separating off the inert solvent or solvent mixture,
d) recrystallizing the compound of the formula (I) from an aprotic hydrocarbon,
e) separating the compound of the formula (I) from the mother liquor.

2. A process as claimed in claim 1, wherein a polar or nonpolar, aprotic hydrocarbon or hydrocarbon mixture is used in step d).

sub A1

3. A process as claimed in claim 1 or 2, wherein toluene, hexane, heptane, xylene, tetrahydrofuran (THF), dimethoxyethane (DME), toluene/THF, heptane/DME or toluene/DME is used in step d).

4. The use of a compound obtained as set forth in claim 1 for preparing a catalyst system for the polymerization of olefins.

5. A catalyst system comprising at least one compound obtained as set forth in claim 1 and a support and, if desired, a cocatalyst.

6. A process for preparing a polyolefin in the presence of a catalyst system as claimed in claim 5.

7. The use of a catalyst as claimed in claim 5 for the polymerization of one or more olefins.